

ENGINEERING SPECIFICATION

FOR

PIPING AND EQUIPMENT COATING IN CATEGORY C AND D AREAS

PUEBLO CHEMICAL AGENT-DESTRUCTION PILOT PLANT (PCAPP) PROJECT

QUALITY LEVEL:

☐ Q

☒ Non-Q

☐ N/A

000	2/21/06	Revised to Incorporate New Quality Level Designation and Issue for Construction	ABB	MGH	MW	ISA	
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Bechtel Pueblo Team			SPECIFICATION No. 24852-RD-3PS-000-A0200				REV 000
			Sheet 1 of 24				

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1 SCOPE

1.1 GENERAL

This Specification covers the minimum requirements for surface preparation, application, inspection, and documentation for Piping and Equipment Painting applied to steel skids, piping and fittings, equipment, accessory surfaces and components in all areas defined as Category C and D, requiring protective finishes for the Pueblo Chemical Agent Destruction Pilot Plant. The extent of coating for all equipment and piping surfaces in Category C areas shall be up to four feet from the floor surface. In Category D areas, Piping and Equipment shall receive non-Epoxy coatings.

Unless indicated otherwise, all coats of paint shall be applied to steel surfaces in the shop. Categories A, and B will be covered by specification 24852-RD-3PS-A0190.

This Specification is accompanied by equipment drawings and/or data sheets, which may supersede the requirements of this Specification. If in the Seller's interpretation suggests a conflict between this Specification, the equipment drawings, data sheets, paint manufacturer's standards or supplemental specifications, the Seller shall contact the Buyer and obtain a written clarification before proceeding with any work.

Attachment A contains a description of generic coating materials, coating material codes, coating system codes, and qualified products. Surfaces listed in the COATING SCHEDULE, other than those listed in paragraphs 1.2 and 1.2.2 below, will receive the surface preparation, coatings, and number of coats prescribed in Attachment B. Attachment C contains color and marking requirements.

1.2 ITEMS INCLUDED

Provide all required equipment, labor, materials, and supervision to clean and coat designated structures components, and surfaces as defined in Attachment B.

Protect all adjacent surfaces, items, and equipment during all phases of work.

Inspection of each phase of the work and documentation of acceptance.

Environmental control equipment to provide the application and curing conditions required.

Touch-up and repair of defective or damaged coatings.

1.2.1 Surfaces Not Requiring Coating

The following listed items will not require coating:

- Pre-finished Items – unless otherwise indicated, factory-finishing or installer-finishing shall be Manufacturer's Standard finished as is normally specified for such items as (but not limited to) finished mechanical and electrical equipment, including light fixtures, switch-gear, and distribution cabinets.

- Concealed Surfaces – Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, and elevator shafts.
- Finished Metal Surfaces – Unless otherwise indicated, metal surfaces of stainless, chromium, Hastelloy, and Titanium will not require finish painting.

1.2.2 Surfaces for Which Coating is Prohibited

- Surfaces within two inches of field welds, unless otherwise specified.
- Rubber, elastomers, or similar nonmetallic parts, unless otherwise specified.
- Machined surfaces, unless otherwise specified.
- Stainless steel, chromium plate, hastelloy, titanium, plastic, or reinforced plastic surfaces, unless otherwise specified.

1.2.3 Operating Parts

Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, and motor and fan shafts will not require finish coating.

1.2.4 Labels

Do not coat over any code-required labels, such as Underwriters Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates, tracks and track trolleys, sprinkler heads, and fire-detection element, or fiberglass grating, stairs, or handrails.

1.3 PIPE COLOR CODE MARKING

For exposed pipes and pipes concealed in an accessible area, pipe surfaces shall be provided with color band, directional arrow, and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 40-foot spacing on straight pipe runs, adjacent to change in directions, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in Attachment D, "Pipe Color Scheme", and in accordance with ASME A13.1. Letter sizes, Band Width, Length, Arrow Length, and Size of Legend, shall be listed in Attachment D. Marking shall be coated or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Color Code marking shall be as specified for both insulated and uninsulated piping.

1.4 SAFETY AND ENVIRONMENTAL

1. All surface preparation, materials, and coatings work shall comply with all applicable environmental and safety provisions, laws, regulations, ordinances, etc., of the city, county, state, province, or nation pertaining to the work being performed and the coating materials being used. Work being performed in the United States shall also be in strict accordance

with Federal (OSHA 29CFR 1910.144), State, and local safety and environmental requirements.

2. Seller shall comply fully with OSHA Hazard Communications Standard 29 CFR 1910.1200 or the applicable country code. Material Safety Data Sheets (MSDS) shall be provided by the materials supplier and available at the place of application for review.
3. The volatile organic compound (VOC) content of all materials shall meet Federal, State, and Local or other Regulatory requirements.

2 APPLICABLE DOCUMENTS

The following codes, standards and specifications listed below from a part of this specification to the extent referenced. They are referred to in the text by the basic designation only. The applicable edition is as listed and any addenda shall be the latest published on the date of issue of the Purchase Order. In the event of a conflict between the referenced document and the contents of this specification, the Buyer shall be notified to resolve the conflict.

2.1 CODES AND STANDARDS

Sponsor	Number	Subject
ASTM	D 520-84 (2000)	Standard Specification for Zinc Dust Pigment
ASTM	D 4417-93 (2003)	Field Measurement of Surface Profile of Blast Cleaned Steel
ASTM	D 4541-95 (2002)	Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM	E 337-84 (2002)	Test for Relative Humidity by Wet-and-Dry-Bulb Psychrometric
ASTM	D 3359-97 (2002)	Standard Test Method for Measuring Adhesion by Tape Test
ASTM	A 123 (2002)	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
FED STD	595 (rev B)	Colors
FED STD	313	Symbols For Packages and Containers For Hazardous Industrial Chemicals and Materials
OSHA	29CFR1910.144	Safety Color Code
OSHA	29CFR1910.1200	Hazard Communications Standard
OSHA	29CFR1926.59	Labeling of Hazardous Materials
SSPC	SP-1 (Nov. 1982)	Solvent Cleaning
SSPC	SP-3 (Nov. 1982)	Power Tool Cleaning
SSPC	SP-5 (Sept. 2000)	Abrasive Blast Cleaning to White Metal
SSPC	SP-6 (Sept. 2000)	Commercial Blast Cleaning
SSPC	SP-7 (Sept. 2000)	Brush-Off Blast Cleaning
SSPC	SP-10 (Sept. 2000)	Near White Blast Cleaning
SSPC	SP-11 (July 1995)	Power Tool Cleaning to Bare Metal
SSPC	VIS 1-89	Visual Standards for Abrasive Blast Cleaned Steel
SSPC	VIS 3 (July 1995)	Visual Standard for Power and Hand Tool Cleaned Steel

Sponsor	Number	Subject
SSPC	PA 2 (Aug. 1991)	Measurement of Dry Paint Thickness with Magnetic Gauges
SSPC	AB 1 (June 1991)	Abrasive Specification No. 1 Mineral and Slag Abrasives
SSPC	AB 3 (May 1997)	Newly Manufactured or Re-Manufactured Steel Abrasive
FS	TT-P-19	Rev. D. Paint. Latex.
ASME	A13.1	Scheme for Identification of Piping Systems

2.2 OTHER DOCUMENTS

24852-RD-3PS-000-T0001	Engineering Specification for Supplier Quality Assurance
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3 REQUIREMENTS

3.1 INSTRUCTIONS

3.1.1 Application Procedure

The coating material manufacturer's current printed product description, material safety data sheets (MSDS), and technical data sheets for each coating product shall be furnished with the bid. MSDS submittals shall meet the requirements of FED-STD 313. Detailed mixing, thinning, and application instructions, minimum and maximum application temperature and drying times between coats, shall be included. Touch-up and damage repair procedure including repair of any destructive testing sites shall be covered in detail. All application and repair procedures shall be submitted and accepted prior to any work being performed.

3.2 REPORTS

3.2.1 Certificates

A certificate of compliance shall be furnished attesting that all paints proposed for use contain not more than 0.06 percent lead.

A certificate stating the coating contains no mercurial mildewcide or insecticide

3.2.2 Volatile Organic Compound (VOC) Content;

Certificate stating that coatings meet the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

3.2.3 Samples

While the material is at the site or source of supply, and at a time agreeable to the Buyer and the Seller a 1-quart sample of each color and batch, except for quantities of 50 gallons or less, shall be taken by random selection from the sealed containers by the Seller in the presence of a representative of the Buyer. The contents of the sampled containers shall be thoroughly mixed

to ensure that the sample is representative. Samples shall be identified by designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

4 MATERIALS

4.1 GENERAL

Coating materials shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service. Equivalent materials manufactured by other industrial suppliers may be submitted for consideration.

The Seller shall furnish satisfactory documentation from the manufacturer of the proposed substitute product that the material meets the requirements and is equivalent or better.

Materials for touch-up of coated surfaces shall be the same as those originally applied.

Colors shall be selected from manufacturer's standard colors as indicated. Tinting shall be done by the manufacturer.

Coating shall not contain mercurial mildewcides or insecticides. Coatings shall not contain lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal).

4.2 MATERIAL MANUFACTURERS

1. Unless otherwise specified, all coating material shall be as specified by the Buyer in Attachment A. Materials from other manufacturers shall not be used without written acceptance from Buyer.
2. Unless otherwise specified, all coating materials used on any one surface or piece of equipment shall be products accepted by the Buyer. Materials from different manufacturers shall not be used over each other without prior written acceptance.
3. The coating materials shall be in pre-measured units. The approved coating materials for each system shall be as shown in this specification. Only the materials approved shall be used.

4.3 MACHINED SURFACES

Machined surfaces not specified to be coated with a specific coating system shall be protected with a solvent cutback asphalt temporary preservative (Tectyl 890, Cosomoline 1058, Rust-Ban 373, or equal) or Buyer's accepted equivalent.

4.4 PACKAGING, LABELING AND STORAGE

Coatings shall be in sealed containers and legibly show the designated name, formula or specification number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warning and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons.

Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need. Emulsion paints shall be stored to prevent freezing or over heating.

4.5 COLORS AND TINTS

Colors shall conform to FED-STD 595 and shall be as listed on the drawings, data sheets and project documentation. The color of the undercoats shall vary slightly from the color of the next coat.

4.6 ABRASIVES

Abrasives for blast cleaning shall be clean, free of oil or contaminants, and dry. The particle size shall be capable of producing the specified surface profile. Mineral and slag abrasives shall meet the requirements of SSPC AB 1. Steel abrasives shall meet SSPC-AB 3.

4.7 THINNERS, SOLVENTS AND CLEANERS

Thinners, solvents, and cleaners shall be as recommended by the coating manufacturer and shall be identified by product number or generic formulation. Cleaning solvents shall be of low toxicity with a flash point in excess of 100°F.

4.8 SURFACE PREPARATION

1. Prior to the start of work, the Seller shall examine all surfaces to be coated to determine their acceptability for the specified work. If the surfaces are found to be unacceptable, the Seller shall either return the surface to an acceptable condition or immediately notify the Buyer in writing if the repairs are outside the scope of work. Work shall not commence until corrective action has been taken. Commencement of work prior to the taking of corrective action shall preclude any subsequent claim by the Seller. The Buyer may require corrective action at the Seller's expense.
2. Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Exposed ferrous metals, including nails on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas. All surfaces shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be of low toxicity with a flash point of excess of 100 degrees. F.
3. All water shall be removed from the surface prior to beginning surface preparation. The substrate surface temperature shall be at least 5°F (3°C) above the dew point.
4. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Items removed prior to painting shall be replaced when painting is completed.
5. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat and shall be completely removed prior to application of the specified primer.

4.9 STEEL SURFACES

1. Prior to blast cleaning, oil, grease, and heavy dirt shall be removed by solvent cleaning in accordance with SSPC-SP-1.
2. Surfaces to be coated shall be cleaned as defined in Attachment B. Where abrasive blasting is impractical, SSPC-SP-11 Power Tool Clean to Bare Metal may be substituted only in limited areas and only with Buyer's written approval.
3. The surface profile of steel prepared by abrasive blast cleaning shall be as recommended by the coating material manufacturer.
4. Blast cleaning shall not be performed in the immediate area where coating or curing of coated surfaces is in progress. All surfaces and equipment which are not to be coated shall be suitably protected from blast cleaning.
5. Burrs, slivers, scabs, laminations, and weld spatter which become visible after blasting shall be removed.
6. Should visible rusting occur or the cleaned surface become wet or other wise contaminated, the surfaces shall b e re-cleaned to the degree specified above.
7. After blast cleaning and immediately before coating, dust shall be removed with compressed air, free of oil and moisture. Vacuuming shall be used if the surface cannot be made dust free using compressed air, as determined by the Buyer's inspector.
8. Machined surfaces shall be wiped with clean solvent before the application of machined-surface coating and shall be protected from damage due to cleaning and coating operations.
9. Machined portions of pipe flanges and other machined mating faces which will not be exposed after final fit-up shall be masked and covered with plywood or otherwise protected from surface preparation and coating activities. The remaining part of the flange face (including bolt holes) or exposed surface shall then be blasted and coated.
10. Equipment shall have all openings plugged, masked, and/or blinded sufficiently to protect internals before abrasive blasting. After the coating operations is complete, all internals shall be blown clean or vacuumed to remove any dust or abrasive blast media that my have entered the coated equipment.
11. Exposed ferrous metals, including nails on or in contact with surfaces to be painted with protective coating systems, shall be spot-primed with a suitable corrosion inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

4.10 GALVANIZED AND NONFERROUS SURFACES

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous surfaces to be painted shall be solvent-cleaned in accordance with SSPC-SP1.

4.11 STEEL WHICH HAS BEEN SHOP PRIMED ONLY

After erection and/or installation but before top coating (if required), items previously primed shall be examined for damage and for unprimed areas. All oil and grease shall first be removed in accordance with SSPC SP1. Following solvent cleaning all loose dirt, chalk, and other contaminants shall be removed by high pressure water wash or other Buyer approved techniques. Unprimed and damaged areas shall be power tool cleaned in accordance with SSPC SP-11 or spot blasted to the degree as originally specified.

4.12 MIXING AND APPLYING COATINGS

1. Mixing, applying, and curing of the coating material shall be in accordance with the manufacturer's latest published instruction and the requirements specified herein. When multiple component units are mixed, each component shall be mixed separately prior to the mixing of the combined materials. Only complete kits shall be mixed; no partial kits will be allowed at any time.
2. Coating materials shall be thoroughly mixed until they are smooth and free from lumps. Then strained through a 30 mesh or finer screen. Material shall be agitated to keep the solids in suspension.
3. Coatings shall be applied only within the temperature and humidity ranges recommended by the coating manufacturer.
4. The cleaned surface shall be coated before any visible rust forms on the surface. Coating material shall not be applied when there is moisture on the surface, dust is present which can contaminate the freshly coated surface, or when dirt or other detrimental material has re-contaminated the surface.
5. The application of the coating shall be performed only when the steel surface is at least 5° F (3°C) above the dew point. Except for solvent based ethyl silicate inorganic zinc, the relative humidity shall not exceed 85 percent during coating application and cure. For solvent based inorganic zinc, the humidity shall not exceed 95 percent. If the humidity falls below 50 percent, the cure of the solvent based inorganic zinc shall be extended, or the manufacturer's written procedure for cure shall be followed. Both ambient and surface temperature shall be in accordance with the manufacturer's written requirements.
6. Over-coats/topcoats shall be applied within the manufacturer's minimum and maximum recoat times. Each coat within a coating system shall be of contrasting color or shade to facilitate application.
7. Where possible, defects such as runs, sags, drips, and voids shall be corrected as detected during application of the coating.
8. Surfaces which may become inaccessible shall be coated before assembly, tagging, fitting, or welding. Inaccessible surfaces also include lap joint flanges, nozzle necks, lap joint stub ends, lap rings, bolt holes, flanges for exchangers and vessels, and welded joint which become inaccessible after assembly.
9. Coating may be applied by brush, roller, or spray. Masking a line out 4-foot above for changing coating materials is not required, at the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during

application. Each coat shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridged, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying coatings and paints shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to ensure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

4.13 VENTILATION

Adequate ventilation shall be provided during paint application and curing. Respirators shall be worn by all persons engaged in spray coating. Adjacent areas shall be protected by approved precautionary measures.

5 TESTS AND INSPECTIONS

5.1 GENERAL REQUIREMENTS

1. The following steps are subject to inspection by Buyer's representative:
 - a. Following surface preparation and immediately prior to the coating application.
 - b. Following the application and curing of each coat.
 - c. Final inspection and sign-off, in accordance with the project requirements.
2. The Seller shall furnish the necessary testing and inspection instruments, properly calibrated and maintained. Such equipment shall be available for use by the Buyer in conducting surveillance of the work.
3. Compressors used shall be oil free. Quality of the air shall be tested in accordance with ASTM D 4285. The test shall be made for the first use of the compressor, when the conditions warrant, or at the request of the Buyer.
4. At the beginning of each shift and prior to surface preparation and coating application, dew point and relative humidity shall be determined using a sling Psychrometer or an accepted equal following procedures in ASTM E 337. Should conditions change or at the request of the Buyer, dew point and relative humidity readings shall be taken. The substrate temperature shall be a least 5°F (3°C) above the dew point. The work shall not proceed if the ambient temperature or relative humidity is outside the requirements of this specification.

5.2 SURFACE PREPARATION INSPECTION

1. The degree of cleanliness of blast cleaned surfaces shall be determined by comparison with SSPC-VIS 1-89, Visual Standards. The anchor pattern profile depth shall be verified in accordance with ASTM D 4417 or using Testex Press-O-Film replica tape and a spring micrometer.
2. Recirculated shot or grit used for abrasive cleaning shall be tested for presence of oil by immersing in water and checking for oil flotation. Tests shall be made at the start of blasting, approximately every four hours thereafter, and at the end of blasting. If oil is evident,

contaminated abrasive shall be replaced with clean abrasive and re-tested before proceeding. All steel blasted since the last satisfactory test shall be re-blasted.

5.3 COATING INSPECTION

1. The dry film thickness shall be verified in accordance with SSPC-PA 2.
2. The coating shall be visually inspected for defects such as overspray, runs, sags, voids, blistering, peeling, rusting, mud cracking, inadequate cure, and lack of adhesion. Mud cracking must be removed by re-blasting. The Seller shall repair all defects per the approved touch-up and repair procedures. Areas where defective coating have been repaired or replaced shall be reinspected to the original requirements.

5.4 DOCUMENTATION

Surface preparation and coating inspection shall be documented using an accepted Surface Preparation and Coating Inspection Form.

5.5 REMEDIAL WORK

1. Coated surfaces that are damaged during assembly, handling, or shipment shall be repaired in accordance with procedures accepted by the Seller.
2. The surface profile shall be restored to meet the specified surface preparation requirements for cleanliness and profile. The periphery of a damaged area shall be feathered prior to coating application.
3. Precautions shall be taken to protect adjacent coated areas from damage caused by local abrasive blasting. Power tool cleaning shall be done per the requirements of SSPC-SP 11.

6 PREPARATION FOR SHIPMENT

6.1 SHIPPING, HANDLING, AND STORAGE

1. Coating materials shall be delivered to the place of application in the manufacturer's unopened, original containers. Containers which are damaged such that the contents are exposed or missing shall not be used.
2. The material shall be handled and stored in accordance with the manufacturer's latest published instructions and shall be protected from damage, moisture, direct sunlight, and temperatures below 40°F and above 100°F.
3. Materials shall be used before the expiration date of the product. If no expiration date is provided, materials shall be used within 6 months of manufacture.
4. Coated items shall be protected on non-abrasive supports during storage and shipment. Coated surfaces shall be protected from damage during lifting, handling, and shipment until accepted by the Purchaser at the designated destination.

6.2 EQUIPMENT

1. The Seller shall provide equipment capable of regulating and controlling the specified environmental conditions within the work area to perform the work according to the productions schedule accepted by the Buyer.
2. Application equipment shall be equivalent to the equipment recommended by the coating's manufacturer and shall be suitable to apply the coating as specified.
3. Equipment air supply lines shall be equipped with filter/traps to remove moisture and oil as close to the point of use as possible.

7 QUALITY ASSURANCE

7.1 QUALITY ASSURANCE REQUIREMENTS

The Seller shall control the quality of items and services to meet the requirements of this specification, applicable codes and standards, and other contract documents. Documentation shall be prepared and maintained to provide evidence of compliance with approved procedures and this specification.

For Seller furnished items and services, the Seller shall comply with requirements in 24852-RD-3PS-000-T0001.

8 DOCUMENTATION AND SUBMITTALS

Seller shall submit to Buyer a listing of all coating materials, thinners, cleaners and abrasives for surface preparation, to be used in this work which shall identify the specific products by manufacturer and catalog number.

Seller shall submit to Buyer written procedures for storage, handling, surface preparation, environmental control, application sequence, touch-up and repair, curing, and inspection of the coating system for review and permission to proceed prior to use. Conflicts, if any, between the coating manufacturer's recommendations and this specification shall be noted: however, this specification shall prevail.

Seller shall submit to Buyer proposed cleaning and coating verification forms for daily inspection records for review and approval.

9 ATTACHMENTS

Attachment A – Coating Systems

Attachment B – Coating Schedule

Attachment C – Color Scheme

Attachment D – Coating and Identification Schedule for Pipe

Attachment A – Coating Systems

Acceptable Coating Manufacturers and Product Identification

Coating System	Generic Product	D.F.T. Mils	Sherwin Williams	Tnemec	PPG Coatings	International Paint	Carboline Co.
P01	Inorganic Zinc (note 1)	2.0-4.0	Zinc Clad II or II HS	90-96	Metalhide 1001	Interzinc 22 or 22HS	Carbozinc 11 VOC
P02	Organic Zinc	2.0-4.0	Zinc Clad III HS	90-97	97-670 Series	Interzinc 52	Carbozinc 859
P05	Surface Tolerant Epoxy Mastic	4.0-6.0	Macropoxy 646	Series 135	97-145 Series	Interplus 770	Carboguard 954 HB
P13	Epoxy Primer	2.0-4.0	Recoatable Epoxy Primer	Series 69 211 Primer	94-109 Series	Intergard 345	Carboguard 888
P04	Epoxy Finish/ Intermediate Coat (Semi-gloss)	2.0-4.0	Macropoxy HS	Series 69	97-130 Series	Intergard 345	Carboguard 888
P25	Acrylic Finish (Semi-gloss)	1.5-2.5	Metalatex Coating	Series 29	90-474 Series	Intercryl 530	Carbocrylic 3359
P33	Acrylic Latex Galvanizing Primer	2.0-3.0	DMT Wash Primer	Series 6	97-687 Series	Intergard 269	Carbocrylic 120
P06	Silicone Acrylic Primer / Finish Coat	1.0-1.5	Heat-Flex II 450	Series 39-661	97-710 Series	Intertherm 875	Thermaline 4900 VOC
P07	Silicone	1.0-1.5	1200-MSF Series	Series 39-1061	97-724 Series (Note4)	Intertherm 50 (2 coats)	Thermaline 4700 VOC

Notes:

1. Type II zinc per ASTM D 520 shall be used in the formulation. Inorganic zinc primers shall limit the total lead content in zinc powder to 0.01% maximum.
2. Materials have been selected to meet Federal Guidelines for VOC content for miscellaneous metal parts. Alternate materials, as a minimum, shall meet these State and local requirements.
3. Coating applied to faying surfaces of bolted slip critical structural joints shall be qualified in accordance with "Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints". As adopted by the Research Council on Structural Connections.
4. Limited to maximum dry heat temperature of 850°F (454°C).

Attachment B – Coating Schedule

	SYS. CODE	ITEMS	Surf. Prep.	Coat 1	Coat 2	Coat 3	REMARKS
1.0	EQUIPMENT / SKID STEEL (Category C and D areas)						
1.1	Q	Equipment related interior steel such as skid components, base plates, channels, , and other fabricated carbon steel components.	SP-6	P01 with P02 touch up	P25	P25	Complete system is not approved for faying surfaces of a slip critical connection. If req'd P01 may be used as a shop primer with a topcoat being field applied.
1.2	NONE	Equipment related interior steel such as cages, platforms, stairways, walkways, handrail assemblies and grating.	Hot Dip Galvanizing per ASTM A123				
2.0	CARBON STEEL TANKS, VESSELS AND REACTORS (Category C and D areas)						
2.1	U	Uninsulated up to 250°F (120°C)	SP-6	P13	P04	None	Entire system shall be shop applied with field touchup if necessary .
2.2	D	Uninsulated 251°F (121°C) to 400°F (204°C)	SP-10	P04	P06	P06	Entire system shall be shop applied with field touchup if necessary .
2.3	C	Uninsulated 401°F (205°C) to 1200°F (649°C)	SP-5	P07	P07	None	Entire system shall be shop applied with field touchup if necessary .
2.4	NONE	Insulated Surfaces (See Notes 2 & 4)	No Coatings Required				
2.5	J	Steel Stacks	SP-10	P01	None	None	
3.0	STAINLESS STEEL, CHROMIUM PLATE, HASTELLOY, TITATIUM TANKS, VESSELS, AND REACTORS						
3.1	NONE	Inside or outside Areas C and D.	No coatings required.				
4.0	BULK PIPE & FABRICATED PIPE SPOOLS (to include Pipe Supports and Fittings) for Category C & D areas.						
4.1	J	Carbon Steel Pipe – Uninsulated up to 250°F (120°C).	SP-6	P01	P02 touch up	None	See Note 2 & 9.
4.2	J	Carbon Steel Pipe – Uninsulated 251°F (121°C) to 750°F (399°C)	SP-10	P01	P01	None	See Note 2 & 9.
4.3	# C	Uninsulated 751°F (400°C) to 1200°F (649°C)	SP-5	P07	P07	None	See Note 2 & 9.
4.4	NONE	Insulated Surfaces (See Notes 2 & 9).	No Coatings Required.				
4.5	NONE	Stainless steel, Chromium, Hastelloy, Titanium, Plastic pipe – all temperatures.	No Coatings Required.				
4.6	NONE	Bulk Valves and Specialty Items	Manufacturer's Standard				
5.0	NONE	ELECTRIC MOTORS AND EQUIPMENT (Note 5)	Manufacturer's Standard				

Attachment B – Coating Schedule

6.0	NONE	INSTRUMENT & CONTROL VALVES & PANELS (Note 5)	Manufacturer's Standard				
7.0	NONE	PUMPS, COMPRESSORS, and ROTATING EQUIPMENT (Note 3 & 5)	Manufacturer's Standard				
8.0	CARBON STEEL HEAT EXCHANGERS (Category C and D areas)						
8.1	U	Uninsulated up to 250°F (120°C)	SP-6	P13	P04	None	Entire system shall be shop applied with field touchup if necessary.
8.2	D	Uninsulated 251°F (120°C) to 400°F (204°C)	SP-10	P01	P06	P06	Entire system shall be shop applied with field touchup if necessary.
8.3	C	Uninsulated 401°F (205°C) to 1200°F (649°C)	SP-5	P07	P07	None	Entire system shall be shop applied with field touchup if necessary.
8.4	NONE	All Insulated Surfaces. (See Notes 2 & 4)	No Coatings Required.				
8.5	NONE	Stainless Steel, Chromium, Hastelloy, and Titanium.	No Coatings Required.				
9.0	GALVANIZED AND NONFERROUS SURFACES (Category C and D areas)						
9.1	M	If required for Safety Color Coding or other purposes.	SP-1, 2 or 3	P33	P05	None	
9.2	NONE	Galvanized or nonferrous surfaces.	No Coatings Required.				
10.0	SKID MOUNTED EQUIPMENT (Category C and D areas)						
10.1	NONE	All components including base plate, supports, piping, equipment, instrumentation, electrical, etc.	Manufacturer's Standard (Note 5)				
11.0	DUCT, CONDUIT, LOUVERS, CONVECTION ENCLOSURES, GRILLES, AIR OUTLETS, INSTRUMENT STANDS, TUBING, CABLE TRAYS, SUPPORTS, ETC. IN CATEGORY C and D AREAS.						
11.1	NONE	Galvanized, Aluminum and Nonferrous.	No Coatings Required				
11.2	NONE	Carbon Steel.	Manufacturer's Standard				
12.0	ITEMS REQUIRING COMPLETE FIELD REPAINTING OR WHERE CHANGE OF COLOR FOR MANUFACTURER'S STANDARD IS NECESSARY						
12.1	H	All Surfaces (Note 5)	SP-1, 2 or 3	P05	None	None	

Attachment B – Coating Schedule

NOTES:

1. All categories include both carbon steel and low alloy steels up to and including 9 percent chrome. Nonferrous metals shall not be coated.
2. Carbon steel designated to be insulated with Personnel Protection (PP) insulation shall have any uninsulated areas coated the same as for uninsulated conditions. Coating System selection shall be based on actual operating conditions to include upset, steam out, and startup conditions. Coating is not required under insulation. However, it is acceptable to coat under PP insulation with one coat of coating number P01 at Supplier option.
3. Rotating equipment shall include but limited to pumps & motors, compressors, blowers, fans, etc. and will also include all attached components (base plates, instrumentation, piping, and electrical) that make up the assembly/skid item.
4. Clips, supports, lugs, and other appurtenances that may protrude from the insulation, shall be blast cleaned and coated with the coating system used on adjacent areas that meets the appropriate operating temperature range, except finish coat color shall be per Attachment C. If the adjacent area is not specified to be coated, the coating system specified for uninsulated items in the appropriate operating temperature range shall be applied.
5. The manufacturer's standard coating system may be upgraded with one coat of coating number P05 provided the surface preparation and coating is suitable for upgrading. Coatings that have been misapplied or which are incompatible with the upgrade system shall be removed and reworked. A small test patch of P05 shall be applied and visually inspected for wrinkling and lifting and/or subject to an adhesion test to confirm compatibility prior to the coating of the entire unit. One acceptable adhesion test method is ASTM D 3359. An Acceptable test result would be either 4A per Test Method A or 4B per Test Method B. Surface preparation shall be SSPC-SP-1 and SP-2 prior to application of P05.
6. For some coating systems the galvanized or aluminum surface must be roughened or etched prior to coatings application. The coating manufacturer's written instructions shall be followed.
7. Contact surfaces of steel members to be jointed by high tensile bolting in friction type joints shall be galvanized or primed only with P01.
8. All temperatures noted in this schedule shall be actual operating conditions, not design conditions.
9. All surfaces shall receive complete shop applied primer with field applied touchup coat(s) after erection.

Attachment C – Color Scheme

A. SAFETY COLORS

PURPOSE: This Table outlines a uniform color coding system for identification of certain hazards.	
ITEM DESCRIPTION	COLORS
A. Fire protection equipment and apparatus. Includes:	Safety Red
1. Fire prevention equipment	Safety Red
2. Fire alarm boxes	Safety Red
3. Fire blanket boxes, buckets and pails	Safety Red
4. Fire extinguishers, pumps, hydrants, and hose locations	Safety Red
B. Danger	Safety Red
C. Emergency stop bars on hazardous machines. Stop buttons or electrical switches used for emergency stopping of machines.	Safety Red
D. Physical hazards. Includes:	
1. Exposed unguarded edges of platforms, pits, and walls.	Safety Yellow w/ Black Stripes
2. Handrails and guardrails.	Safety Yellow
3. Pillars, posts and columns which might be struck.	Safety Yellow
E. Physical hazards such as obstructed clearances and tripping hazards. (Field Coated).	Safety Yellow
F. Emergency safety equipment such as eye-wash stations, safety showers, or first aid equipment.	Safety Green
G. Dangerous parts of machines or energized equipment. Other uses include:	Safety Yellow
1. Inside of movable and transmission guards for gears, pulleys, chains, etc.	Safety Yellow
2. Safety starting buttons.	Safety Red
3. Exposed edges of pulleys, gears, rollers, cutting devices, power jaws, etc.	Safety Yellow
H. Color for designating information signs and bulletin boards.	Safety Green

Attachment C – Color Scheme

B. PLANT COLOR SCHEME

COMPONENT	COLORS
Tanks	Light Gray
Furnaces and Thermal Oxidizers	Black
Stacks	Black
Insulated Columns, Vessels, Exchangers, Drums	Same as jacket
Uninsulated Columns, Vessels, Drums	Light Gray
Uninsulated Exchangers	Light Gray
Plat forms, Handrails, and Ladders	Light Gray
Motors and Lighting Panels	Selected by Buyer from Manufacturer's Range
Compressors	Selected by Buyer from Manufacturer's Range
Centrifuges, Turbines, Pumps, Machinery	Selected by Buyer from Manufacturer's Range
Transformers	Selected by Buyer from Manufacturer's Range
Panel Switches/Switch Gear Levers	Selected by Buyer from Manufacturer's Range
Electrical Switchgear	Selected by Buyer from Manufacturer's Range
Control Boards	Selected by Buyer from Manufacturer's Range
Fireproofing	Light Gray
Control Valves and Regulators	Selected by Buyer from Manufacturer's Range

Attachment D – Coating and Identification Schedule for Pipe

Uninsulated Carbon Steel Pipe (note 1) with operating temperature (note 2) of <225°F

Service	Coating System	Pipe Color	Band Color	Arrow Color	Title Lettering	Title Color
Agent	PS-1	Gray	Brown	White	AG	White
Agent Hydrolysate	PS-1	Gray	Brown	White	AH	White
Total Hydrolysate	PS-1	Gray	Brown	White	AH	White
Biotreatment Effluent	PS-1	Gray	Gray	Gray	BTE	Black
Boiler Blowdown	PS-1	Gray	Gray	Black	BB	Black
ICB Feed to Bio Reactors	PS-1	Gray	Gray	Gray	ICB-F	Black
Brine, Quench Brine (acidic serv.)	PS-1	Gray	Brown	White	BR	White
Clarifier Effluent	PS-1	Gray	Gray	Gray	CE-EFLU	Black
Process Chilled Water Return	PS-1	Gray	Gray	Gray	CHWR	Black
Process Chilled Water Supply	PS-1	Gray	Gray	Gray	CHWS	Black
Chemical Injection Anti- Foam	PS-1	Gray	Blue	Blue	CI-AF	Black
Chemical Injection	PS-1	Gray	Blue	Blue	CI	Black
CST Effluent	PS-9/9	Silver	Gray	Gray	CST-EFLU	Black
Clarifier Sludge	PS-1	Gray	Gray	Black	CS	Black
Decon	PS-1	Gray	Blue	Blue	DC	Black
Demineralized Water	PS-1	Gray	White	Black	DEMINWTR	Black
Evaporator Feed	PS-1	Gray	Gray	Gray	EF	Black
ERH Effluent	PS-9/9	Silver	Gray	Gray	ERH-EFLU	Black
Energetics Condensate	PS-1	Gray	Gray	Gray	EC-COND	Black
Ferric Chloride	PS-1	Gray	Brown	Brown	FC	White
MPT Condensate	PS-9/9	Silver	Gray	Gray	MPT-COND	Black
Nitrogen	PS-1	Gray	Gray	Blue	GN	Black
Hydraulic Fluid Return	PS-1	Gray	Gray	Gray	HFR	Black
Service	Paint System	Pipe Color	Band Color	Arrow Color	Title Lettering	Title Color
Hydraulic Fluid Supply	PS-1	Gray	Gray	Black	HFS	Black
High Pressure Steam	PS-1	Gray	Gray	Black	HPS	Black

Attachment D – Coating and Identification Schedule for Pipe

Uninsulated Carbon Steel Pipe (note 1) with operating temperature (note 2) of <225°F

Service	Coating System	Pipe Color	Band Color	Arrow Color	Title Lettering	Title Color
Low Pressure Steam	PS-1	Gray	Gray	Black	LPS	Black
Phosphoric Acid	PS-1	Gray	Brown	Brown	PA	White
Energetics Hydrolysate	PS-1	Gray	Brown	White	EH	White
Instrument Air	PS-1	Gray	Gray	Green	IA	Black
1%, 25% and 50% Caustic Solution	PS-1	Gray	Gray	Gray	NH	Black
Inorganic Nutrient	PS-1	Gray	Blue	Gray	IN	Black
Plant Service Air, Air Exhaust	PS-1	Gray	Gray	Gray	PSA	Black
CST Condensate	PS-1	Gray	Gray	Gray	CST-COND	Black
Glycol Water Solution	PS-1	Gray	Gray	Gray	GWS	Black
MPT Condensate	PS-1	Gray	Gray	Gray	MPT-COND	Black
MPT & CST Surge Drum Vent	PS-9/9	Silver	Gray	Gray	MPT/CST-V	Black
MPT Effluent	PS-9/9	Silver	Gray	Gray	MPT-EFLU	Black
Process Water Supply	PS-1	Gray	Gray	Black	PW	Black
Process Water Return	PS-1	Gray	Gray	Black	PWR	Black
Process Cooling Water Return	PS-1	Gray	Gray	Black	PCWR	Black
Process Cooling Water Supply	PS-1	Gray	Gray	Black	PCWS	Black
Polymer	PS-1	Gray	Blue	Blue	PO	Black
12,000 PSI Water	PS-1	Gray	White	Black	HP-W	Black
Room Air	PS-1	Gray	Gray	Green	RA	Black
Room Air - Hot	PS-1	Gray	Gray	Green	RA-H	Black
Recovered Water	PS-1	Gray	Gray	Gray	RW	Black
Reactor Off Gas	PS-1	Gray	Gray	Gray	ROG	Black
Wash Water w/Agent	PS-1	Gray	Gray	Gray	WW/A	Black
Service	Paint System	Pipe Color	Band Color	Arrow Color	Title Lettering	Title Color
Spent Decon	PS-1	Gray	Blue	Blue	SD	Black

Attachment D – Coating and Identification Schedule for Pipe

Uninsulated Carbon Steel Pipe (note 1) with operating temperature (note 2) of <225°F

Service	Coating System	Pipe Color	Band Color	Arrow Color	Title Lettering	Title Color
Secondary Heat Transfer Return	PS-1	Gray	Gray	Gray	SHTR	Black
Secondary Heat Transfer Supply	PS-1	Gray	Gray	Gray	SHTS	Black
Sampling: Agent, Reactor Scrubber Liq., Spray Water Spent Decon	PS-1	Gray	Brown	White	SMP	White
40 psig Steam	PS-1	Gray	Gray	Gray	40# STM	Black
150 psig Steam	PS-1	Gray	Gray	Gray	150# STM	Black
Super Heated Steam	PS-1	Gray	Gray	Gray	SH-STM	Black
Blower Inlet/Outlet	PS-1	Gray	Gray	Gray	BLW	Black
ICB Effluent to Effluent Tank	PS-1	Gray	Gray	Gray	ICB-EFLU	Black
Vent Gas: Agent, Biotreatment, Hydrolysate, Neutralization, Waste Gas	PS-1	Gray	Gray	Gray	VG	Black
Vent to ATM	Color & coat to match service of equipment/piping				VTA	

NOTES:

1. This category includes both carbon and low alloy steels up to and including 9 chrome.
2. Temperature is based on the actual maximum operating temperature. If the line is steamed out for periods longer than four hours, the steam out temperature shall be used.
3. Piping systems located inside Category A, and B shall be coated in accordance with specification 24852-RD-3PS-000-A0190, Piping and Equipment Coatings in A and B Areas.
4. Identification bands, arrows, and titles shall be applied to both insulated and uninsulated piping systems. Color scheme for bands, arrows, and titles shall follow the color scheme outlined in this Attachment.
5. Coating System number is only an indication for determining the proper coating system. Actual coating system(s) will be determined by operating temperatures, insulation (if any) and materials of construction. Piping coating systems will be based on Attachment B criteria.

Attachment D – Coating and Identification Schedule for Pipe

PIPING IDENTIFICATION

<u>Color Code</u>	<u>Primary Color</u>	<u>Meaning</u>
1	Brown	Toxic/Poisonous
2	White	Potable Water/Water
3	Gray	Physically Dangerous
4	Lt. Gray	Special Coatings
5	Blue	Anesthetic/Harmful
6	Green	Oxidizing
7	Yellow	Flammable
8	Red	Fire Protection

BAND WIDTH, LENGTH, AND SIZE OF LEGEND VERSUS PIPE DIAMETER

Outside Diameter of Pipe or Insulation Covering (inches)	Width of Color Band (inches)	Arrow Length x Width (inches)	Size of Legend letters and Numerals (inches)
Less than 1-1/2	1	1-1/2 x 1/2	1/2
1-1/2" to 3-1/2	1	4 x 1	3/4
3-1/2 to 6	2	8 x 2	1-1/4
6 to 9	2	12 x 3	2
9 to 13	2	14 x 4	3
Over 13	6	20 x 5	4